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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/966,741	10/01/2001	Kazuichiroh Itonaga	0819-0658	3606

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EXAMINER	
QUACH, TUAN N	
ART UNIT	**PAPER NUMBER**
2814	

DATE MAILED: 03/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

K.D

Office Action Summary	Application No.	Applicant(s)	
	09/966,741	ITONAGA, KAZUICHIROH	
	Examiner	Art Unit	
	Tuan Quach	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,8,9,19,21,23,24 and 34-45* is/are pending in the application.

4a) Of the above claim(s) *4-6,10-18,20 and 25-33* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,8,9,19,21,23,24 and 34-45* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 October 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claims 1 and 19 are amended. Claims 7 and 22 are cancelled. New claims 32-35 are added. Claims 1-3, 8, 9, 19, 21, 23, 24, 34-45 are examined. Claims 4-6, 10-18, 20, 25-33 are withdrawn from consideration.

Claims 42-44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

"one type of ions" in these claims are indefinite as to what "type" encompasses.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

For convenience, "et al." is omitted.

Claims 1-3, 8, 21, 23, 34, 35, 37-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal.

Regarding claims 1-3, 8, 21, 23, 34, 35, 37-41, Kamal teaches forming gate 106, spacers 108/110, metal 112, first heat treatment to form silciide 122, removing unreacted metal, implanting nitrogen to the silicide, second treatment to form silicide. See Figs. 1-7, column 4 lines 10 to column 5 line 66. Regarding claims 1 and 19, it would have been obvious to one skilled in the art and would have been inherent that the first silicide would be polycrystalline as it corresponds to similar metal deposition and first heating for silicidation, and the implant would render the silicide amorphous, absent

evidence to the contrary, and given that similar processing is employed. The provision of source/drain regions correspond to well known component regions for MOS device and as such would have been obvious. Regarding the first silicide being metal rich now claimed in claims 1 and 19, to the extent such metal rich language can be determined, such would be inherent or otherwise given that the silicide obtained in Kamal contains CoSi thus is metal rich as compared to CoSi2 and that the same processing of first thermal annealing is effected for silicidation in Kamal, column 4 lines 41-44. Regarding the change from the introduction of nitrogen into the first silicide before, in, or after any of the forming a metal film, performing first thermal annealing, removing unreacted metal film, to the introduction of nitrogen into the first silicide after forming the metal film and before removing the unreacted metal, such remains obvious over the teaching in Kamal, as delineated above, and at column 5 lines 35-460 wherein the introduction of nitrogen into the cobalt silicide would reduce agglomeration; the selection of the appropriate sequential processing out of a few possible alternatives would have been obvious; the order of the introduction of nitrogen does not matter since as evidenced by applicant's own disclosure and original claim the introduction can be effected in any order and the interchangeability thereof thus is self-evident. Regarding the cobalt silicide that is rich in cobalt contains a compound of Co2Si and CoSi, to the extent the composition of the respective components can be determined, such would have been inherent and obvious as the same processing is employed, namely the first thermal annealing, and that Co2Si is not precluded from the first cobalt silicide; alternatively, it would have been obvious to one skilled in the art that such first silicide would comprise

such silicides that are not cobalt disilicide during the first thermal annealing. The selection of the implant depth to the surface of the semiconductor layer, e.g., claim 1 last four lines would have been met as shown in Kamal, Fig. 6, wherein the dopant to the surface of the underlying layer is shown, Fig. 8, column 5 lines 8-46 wherein the implant just below the surface of the interface of the CoSi/silicon is explicitly taught thus would correspond substantially to the same extent as claimed and thus the extent of silicidation would follow accordingly. In addition, such optimization would have been obvious as taught in Kamal, column 5 lines 35-59 to prevent agglomeration. In addition, regarding such desired depth of the amorphous state including in claims 39 and 40, such selection and optimization of implant parameters and depth is a matter of routine experimentation and optimization well within the purview of one skilled in the art and as such would have been obvious. Regarding the concentration of nitrogen claimed in claim 19 last two lines, while the Office is not equipped to measure such concentration, such would have been met or other obvious and would have been a matter of routine optimization as taught by Kamal, column 5 lines 35-43 wherein the same objective of reducing agglomeration can be obtained. Regarding the bamboo structure in claim 41, such would be inherent and obvious, absent evidence to the contrary, given that the Office is not equipped to determine the structure as the same processing is employed to form the silicide in question and that the silicide in question does not preclude any bamboo structure. Alternatively, it would have been obvious to one skilled in the art to have employed to have employed conventional bamboo structure if desired.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal as applied to claims 1-3, 8, 21, 23, 34, 35, 37-41 above, and further in view of Iwamatsu.

Regarding claim 9, silicon ions correspond to well known alternative of nitrogen ions as evidenced by Iwamatsu, column 6 lines 63-65, and thus the interchange therebetween would have been obvious.

Claims 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal as applied to claim 1 above, and further in view of Ghandhi.

Regarding the alternative ions delineated, such corresponds to well known neutral ions and p-type or n type ions well known in the art as evidenced by Ghandhi, page 312, and as such interchangeability would would have been obvious.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal as applied to claims 1-3, 8, 21, 23, 34, 35, 37-41 above, and further in view of Delfino and Koyanagi.

Although Kamal does not recite the preclean and nitrogen plasma, such use would have been conventional and advantageous as evidenced by Delfino, the abstract, wherein plasma treatment would serve to provide a clean surface for silicidation, and as evidenced by Koyanagi, column 11 lines 15-17, where nitrogen plasma corresponds to a well known alternative to ion implantation.

Claims 19 and 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal taken with Frankel and Ichimori.

Kamal is applied as above regarding claims 1-3, 7, 8, 21-23, 34, 35, 37-41 and does not explicitly recite the second treatment of less than 725°C.

Frankel teaches temperature for second annealing including temperature at 700°C. See column 6 lines 42-44.

Ichimori also teaches the two annealing steps for cobalt silicidation wherein the first annealing is between 400 and 600 °C (column 3 line 53 to column 5 line 63) wherein the second annealing temperature at 700 °C is employed for obtention of film evenness and to optimization crystallization. The CoSi would be cobalt rich prior to the second annealing and as delineated in Kamal above.

It would have been obvious and would have been within the purview of one skilled in the art in practicing Kamal or Ichimori to have selected a temperature below 725 °C, since such corresponds to conventional temperature as evidenced by Frankel and since such temperature selection and optimization including the claimed range is conventional and advantageous as evidenced in Ichimori to improve evenness.

Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamal as applied to claims 1-3, 8, 21, 23, 34, 35, 37-41 above, and further in view of Frankel and Ichimori.

Kamal is applied as above regarding claims 1-3, 7, 8, 21-23, 34, 35, 37-41 and does not explicitly recite the second treatment of less than 725°C.

Frankel teaches temperature for second annealing including temperature at 700°C. See column 6 lines 42-44.

Ichimori also teaches the two annealing steps for cobalt silicidation wherein the first annealing is between 400 and 600 °C (column 3 line 53 to column 5 line 63) wherein the second annealing temperature at 700 °C is employed for obtention of film

evenness and to optimization crystallization. The CoSi would be cobalt rich prior to the second annealing and as delineated in Kamal above.

It would have been obvious and would have been within the purview of one skilled in the art in practicing Kamal or Ichimori to have selected a temperature below 725 °C, including between 650 and 700° since such corresponds to conventional temperature as evidenced by Frankel and Ichimori and since such temperature selection and optimization including the claimed range is conventional and advantageous as evidenced in Ichimori to improve evenness.

Applicant's arguments filed January 23, 2004 have been fully considered but they are not persuasive.

Initially, see the new grounds of rejection delineated above regarding the newly added limitations.

Applicant argues that Kamal does not teach forming silicide layer rich in metal. Nonetheless, this is taught at column 4 line 40-45.

Applicant further argues that Kamal discloses implanting nitrogen after removing the unreacted metal. Nonetheless, regarding the change from the introduction of nitrogen into the first silicide before, in, or after any of the forming a metal film, performing first thermal annealing, removing unreacted metal film, to the introduction of nitrogen into the first silicide after forming the metal film and before removing the unreacted metal, such remains obvious over the teaching in Kamal, as delineated above, and at column 5 lines 35-460 wherein the introduction of nitrogen into the cobalt silicide would reduce agglomeration; the selection of the appropriate sequential

processing out of a few possible alternatives would have been obvious; the order of the introduction of nitrogen does not matter since as evidenced by applicant's own disclosure and original claim the introduction can be effected in any order and the interchangeability thereof thus is self-evident.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number (571)272-1717. The examiner can normally be reached on M - F from 9 to 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Wael Fahmy can be reached on (571)272-1705. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1562.

TQuach

Tuan Quach
Primary Examiner